REMARKS

In the Office Action, claims 1-10 are rejected under 35 U.S.C. §103(a) as being obvious in view of Japanese Patent No JP2001-001645 to Tonoi et al. ("*Tonoi*") and U.S. Patent No. 5,296,439 to Maruyama et al. ("*Maruyama*"). The Patent Office primarily relies on *Tonoi* and further relies on *Maruyama* to remedy the deficiencies of same. Applicants respectfully disagree with and traverse the rejections for at least the reasons set forth below.

At the outset, Applicants are submitting herewith an English language translation of the *Tonoi* reference of which they have relied on for purposes of responding to the Office Action. Applicants are also submitting herewith a Supplemental Information Disclosure Statement where the English language translation is being submitted for entry and examination on the record.

Applicants also note that on April 23, 2004, Applicants submitted a Supplemental Information Disclosure Statement for the above-identified patent application. The Information Disclosure Statement as well as PTO form and references were received by the Patent Office on April 27, 2004, as indicated by the bar code stamp on the postcard Applicants submitted with the Information Disclosure Statement. Applicants have not received back from the Examiner an initialed PTO Form 1449 confirming that all of the references have been considered. Applicants respectfully request that the Patent Office, to the extent it has not considered the references, consider the references and indicate the same by returning to Applicants undersigned attorney the initialed PTO Form 1449. Copies of the references were included, but we will provide additional copies if necessary.

Of claims 1-10, claims 1, 5 and 6 are the sole independent claims. Claim 1 recites a reversible multicolor recording medium including a supporting substrate and a plurality of recording layers including, respectively, a plurality of reversible thermal coloring compositions having different colors, where the plurality of recording layers are separated from and stacked on one another on said supporting substrate. The plurality of reversible thermal coloring compositions respectively includes light-to-heat transforming materials which absorb infrared rays having different wavelength ranges to generate heat.

Claim 5 recites a recording method. The method includes using a reversible multicolor recording medium comprising a supporting substrate, and a plurality of recording layers including, respectively, reversible thermal coloring compositions having different colors, wherein the plurality of recording layers are separated from and stacked on one another on said

supporting substrate, and the plurality of reversible thermal coloring compositions respectively include light-to-heat transforming materials which respectively absorb infrared rays having different wavelength ranges to generate heat. The recording method further includes heating said recording medium so that each of said plurality of recording layers is in a decolored state, irradiating said recording medium with an infrared ray having a wavelength range corresponding to the recording layer selected from said recording layers in accordance with predetermined image information, and recording said image information by making the recording layer generate heat and selectively coloring the recording layer.

Claim 6 recites a recording method. The recording method includes using a reversible multicolor recording medium comprising a supporting substrate, and a plurality of recording layers including, respectively, reversible thermal coloring compositions having different colors, wherein said plurality of recording layers are separated from and stacked on one another on said supporting substrate, and said plurality of reversible thermal coloring compositions respectively include light-to-heat transforming materials which respectively absorb infrared rays having different wavelength ranges to generate heat. The recording method further includes heating said recording medium so that each of said plurality of recording layers is in a colored state, irradiating said recording medium with an infrared ray having a wavelength range corresponding to the recording layer selected from said recording layers in accordance with predetermined image information, and recording said image information by making the recording layer generate heat and selectively decoloring the recording layer.

The reversible multicolor recording medium of the present invention includes light-to-heat transforming materials which respectively absorb infrared rays having different wavelength ranges to generate heat and are uniformly dispersed, respectively, in reversible thermal coloring compositions having different colors. A plurality of layers comprising the respective compositions are stacked on one another. In contrast, the primary *Tonoi* reference does not include a plurality of reversible thermal coloring compositions including light-to-heat transforming materials, as even admitted by the Examiner. See, Office Action, pg. 2. As discussed in Comparative Example 1 on page 25, line 12 of the specification, *Tonoi* discloses a recording medium in which a recording layer and a light-to-heat transforming layer are stacked on top of one another.

In addition to the structural differences discussed above, the claimed invention is distinguishable over *Tonoi* in several ways. The claimed invention includes a recording medium that has highly stable coloring and decoloring properties, excellent contrast, and high image stability. The recording medium also exhibits a quicker printing time and is erasable. Furthermore, in the reversible multicolor recording medium of the present invention the light-to-heat transforming material layer and the recording layer are not separately provided. Rather, one layer is provided that has functions of both of these layers. Therefore, the production process for the recording medium is simplified and therefore advantageous from the viewpoint of reduction in the cost. The results of the comparison between *Tonoi* and the present invention illustrate several unexpected advantages of the claimed invention, as outlined below.

The first comparison involved the measurement of recorded line width between the claimed invention and *Tonoi*. An arbitrary position of the reversible multicolor recording medium as a sample was irradiated with semiconductor lasers having three different wavelengths, i.e., 785 nm, 830 nm, and 915 nm and having a power of 70 mW and a spot diameter of 80 μm while scanning the lasers at speeds of 300 mm/sec and 500 mm/sec to measure a recorded line width. The results of measurement of the recorded line width at a scanning speed of 300 mm/s are shown in Table 1 on page 32 of the specification, and the results at a scanning speed of 500 mm/s are shown in Table 2 on page 33. From the results shown in Tables 1 and 2, it is found that the recorded line width in each of the media in Examples 1 and 3 is larger than the recorded line width in the medium in *Tonoi*, indicating superior transformation of light-to-heat to color in the recording layers in Examples 1 and 3.

The second comparison involved measurement of reflection density between the claimed invention and *Tonoi*. Parallel lines were recorded at a space of 60 μm on an arbitrary position of the reversible multicolor recording medium as a sample using semiconductor lasers having wavelengths of 785 nm, 830 nm, and 915 nm and having a power of 70 mW and a spot diameter of 80 μm under conditions such that the scanning speed was 300 mm/s, so that a solid image was recorded. With respect to the recorded sample, a reflectance was measured by means of an autographic spectrophotometer having an integrating sphere to determine a reflection density (reflectance) at a peak wavelength. The results of the evaluation are shown in Table 3 on page 35 of the specification. It was found that the solid image recorded on the medium in Example 3 has a higher reflection density than that of the solid image recorded on the medium in *Tonoi*,

indicating superior transformation of light-to-heat to color in the recording layers in Example 3. In other words, in the recording medium of the present invention, by virtue of employing the construction in which the light-to-heat transforming material is uniformly dispersed in the recording layer, the recording sensitivity and the reflection density can be improved.

The third comparison involved and evaluation of decoloring properties between the claimed invention and *Tonoi*. Parallel lines were recorded at a space of 60 μm on an arbitrary position of the reversible multicolor recording medium as a sample using semiconductor lasers having wavelengths of 785 nm, 830 nm, and 915 nm and having a power of 70 mW and a spot diameter of 80 μm under conditions such that the scanning speed was 300 mm/s, so that a solid image was recorded. Then, the sample was irradiated with semiconductor lasers having wavelengths of 785 nm, 830 nm, and 915 nm and having a power of 70 mW and a spot diameter of 200 μm while scanning the lasers at a speed of 200 mm/sec to erase the recorded portion. With respect to the erased sample, a reflectance was measured by means of an autographic spectrophotometer having an integrating sphere to determine a difference between the reflection density (reflectance) at a peak wavelength and the reflection density of the primary (unrecorded) surface (primary surface density). The results of the measurement are shown in Table 4 on page 36 of the specification. It was found that the recording medium in Example 3 has a reflection density of the erased portion of 0.02 or less at each wavelength and is in an almost colorless state, whereas, the medium in *Tonoi* has a reflection density of the erased portion higher than that in Example 3, indicating that the erasing is unsatisfactory in *Tonoi*. This is because the recording medium in Example 3 has a construction such that the light-to-heat transforming material is uniformly dispersed in the recording layer, and therefore heat transfer in the recording layer is uniform, so that the recorded portion can be efficiently erased. By contrast, the medium in *Tonoi* has a light-to-heat transforming layer and a recording layer which are independently provided, and hence a heat gradient is caused in the recording layer and a portion remaining colored is caused or the recording layer locally reaches the coloring temperature and satisfactory decoloring cannot be achieved, so that the reflection density becomes higher. Further, in the reversible multicolor recording medium of the present invention having the construction in which the light-to-heat transforming material is uniformly dispersed in the recording layer, satisfactory decoloring properties can be obtained.

The fourth comparison involved an evaluation of repetition properties between the claimed invention and *Tonoi*. Lines were recorded on a desired position of the reversible multicolor recording medium as a sample using semiconductor lasers having wavelengths of 785 nm, 830 nm, and 915 nm and having a power of 70 mW and a spot diameter of 80 μm under conditions such that the scanning speed was 300 mm/s, and then the lines were erased using a ceramic bar at 120°C. This test operation was repeated 100 times with respect to the same portion of each medium. The recorded portion was examined through a microscope to evaluate deterioration of the sample, and the results are shown in Table 5 on page 38 of the specification. In the medium in Example 3, after 100 recording and erasing cycles, no deterioration was observed in the recording layer. However, in the medium in *Tonoi*, after the 100th recording and erasing cycle, deterioration was found in the center portion of the recorded lines in the recording layer. The reason for this is that, in the medium in *Tonoi*, the light-to-heat transforming layer is thin and transforms light-to-heat such that the temperature of this layer locally rises, causing the recording layer to locally deteriorate. It is presumed that, in Example 3 according to the method of the present invention, by virtue of having the construction in which the light-to-heat transforming material is uniformly dispersed in the recording layer, a local occurrence of overheating is prevented, improving the durability of the recording layer. Therefore, the claimed invention has several measurable advantages over *Tonoi*, as discussed above.

Furthermore, Applicants submit that *Maruyama* is not properly combinable with *Tonoi*. *Maruyama* generally discloses a reversible thermosetting coloring recording medium and method of use thereof. In contrast to the claimed invention, *Maruyama* is primarily focused on a particular reversible thermosensitive coloring composition. As the Examiner has noted, *Maruyama* teaches that when an optical recording layer does not inherently absorb light (to convert to heat energy) that a light absorbing layer be formed in contact with or near the recording layer. See, *Maruyama*, col. 41, line 62 to col. 42, line 4. This particular structural arrangement is similar to the teachings of *Tonoi*, except that *Tonoi* teaches stacking a plurality of layers on top of one another.

However, contrary to the Examiner's assertion, *Maruyama* does not teach the equivalence of employing light-to-heat transforming material in the optical recording layer. *Maruyama* first introduces the two layer stacking approach as discussed above and then adds that "when necessary, a light-to-heat material can be added in the" recording layer. See, *Maruyama*,

col. 42, lines 15-17. Not only does *Maruyama* fail to teach or arguably suggest any potential benefits as outlined above, but actually teaches that it would be preferable to utilize a separate layer of light-to-heat transforming material because "the light-to-heat conversion layer of the optical recording medium can be used as a light reflection medium" which is "especially advantageous when reflection light is utilized." See, *Maruyama*, col. 42, lines 29-38. For at least these reasons, Applicants respectfully submit that one skilled in the art would not look to *Maruyama* in order to modify *Tonoi* to include a plurality of recording layers which include a plurality of reversible thermal coloring compositions having different colors, where the plurality of reversible thermal coloring compositions respectively include light-to-heat transforming materials, as required by the claimed invention. What the Patent Office has done is to improperly rely on hindsight reconstruction in support of the obviousness rejection.

Accordingly, Applicants respectfully request that this obviousness rejection be withdrawn.

For the foregoing reasons, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicit reconsideration of same.

Respectfully submitted,

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